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[OFFICIAL NOTICE.]

American Gas Light Association.

OFFICE AMERICAN GAS LIGHT ASSOCIATION,
142 CHAMBERS STREET, NEW YORK.

To the Members of the Association:

The Ninth Annual Meeting of the American Gas Light Association will be held in Boston, on Wednesday, Oct. 19th, and continue for three days.

Members of the Association are earnestly requested to prepare papers upon the many topics of general interest, to be read at that meeting. The Secretary counts upon the active co-operation of the members in his efforts to render the meeting of marked value.

WM. HENRY WHITE,
Secretary.

THE USE OF GAS FOR OTHER PURPOSES THAN LIGHT.

Much more consideration has been given to the question of extending the uses of gas for other purposes than light during the past three years than during any other like period of time since lighting by gas was first introduced. This increased attention to the development of this branch of our industry is, doubtless, largely due to the anticipation by some that a portion of the lighting, now done by gas, will pass into other hands.

There has been necessarily much thought devoted to the question of the possible rivalry of the electric light with our industry; but for many reasons it has not been considered probable, by those largely interested and quite competent to judge, that electricity will ever become a serious competitor. Although some of the field now occupied by us may, for a time, be lost, there is every reason to believe it will be recovered, and that the future consumption of gas, in the very direction in which there may be losses, will be largely increased, as experience shows that the more light the public has the more it requires. Among the reasons for full faith in the future are the two following: 1st, the margin for improvements and economies in the manufacture, distribution, and consumption of gas is very great; and, 2d, the light obtained by the combustion of gas is of such a superior character, as regards softness, steadiness, and diffusibility, that it cannot be successfully imitated in electric lighting either by means of the arc or incandescent systems. It appears that the present popularity and extended use of gas, irrespective of the question of cost, are largely due to these important and unique characteristics.

Other considerations of greater importance urge many to foster a consumption of gas in new uses, as they are aware of the great benefits arising from an increased day consumption, and a more than proportionately increased summer consumption. An increased day consumption can be supplied without addition to the storage or distributing plant, and, the outside expenses remaining nearly or quite constant, this increased supply therefore costs little more than its expense in the holder, and, consequently, renders possible, if the sales of gas are large enough, a reduced price for gas all round. If the cost of gas at the consumer's meter be placed under the following heads—cost in holder, cost of distribution, cost for interest—it will be found that by far the heaviest item of cost in this country is that for interest.

Now it is evident that every foot of gas sold in a new field will enable a certain reduction to be made for the item of interest; not only so, but a larger consumption, within certain limits, tends to reduce the other expenses of gas making and distributing. Moreover, a reduction in price to the consumer generally brings an increased consumption to compensate for it, and it seems quite as true with gas as with other industries that reasonable profits, derived from a large business, promise greater security than if the same amount were realized from a smaller trade.

It is quite safe to predict that the consumption of gas, for other purposes than light, will, with proper attention on the part of those most largely interested, naturally and steadily increase, and it is possible that, in the future, the demand may be large enough to warrant a separate works and set of mains for the production and distribution of a gas for heating purposes. This condition will not exist, however, until it can be clearly shown that a gas for heating purposes, and equally efficient, can be made and sold more cheaply than the present ordinary illuminating gas.

It is so apparent that many and manifold advantages, as regards convenience, reliability and economy, exist in having one gas that is suited for light, heat, and power, made at one works, and distributed through one set of pipes, as scarcely to need stating. The question of taking the gas that has a low illuminating power, and is produced during the first and second parts of the charge, and storing it for fuel purposes, and taking the balance as possessed of greater illuminating power, and storing it for illuminating purposes, was freely discussed, and its practicability shown to be questionable, at the late meeting of the British Association of Gas Managers. It might be asked whether, if such a plan were carried out, the fuel gas, produced by the high heats now, for the sake of economy, necessarily used, would not be so wanting in hydrocarbon vapors as to cause great trouble by depositing naphthaline. A great difficulty exists even now in handling a comparatively low grade gas made from caking coals.

There has been of late much discussion about the relative heating power of different gases, and considerable confusion has arisen because some have not borne in mind the elemental facts that gas is now, and probably ever will be, sold by volume and not by weight; and, on the other hand, that the calorific power of combustibles is almost invariably tabulated from the relative amount of heat evolved by their equal weights. For instance, the calorific power of hydrogen by weight is nearly three times that of olefiant gas, yet by volume, as we measure and sell, the calorific power of one cubic foot of olefiant gas is nearly five times that of one cubic foot of hydrogen, and of marsh gas a cubic foot is equal in calorific power to nearly three of hydrogen. The calorific power of a cubic foot of hydrogen or carbonic oxide is nearly the same, and is low, whereas that of olefiant gas and marsh gas is high. Of course the calorific power does not always represent the comparative practical value of combustibles, as for some special uses the question of their calorific intensity has also to be considered. But this question of calorific intensity is of no importance as between the gas ordinarily made and used in the cities of the world, and any other gas whose introduction might be considered.

All the later discussions and calculations, satisfactory calorimetric results apparently not having been obtained, tend to confirm the accuracy of the experiments, made by the calorimeter, judging from the context, of Mr. F. J. Evans, recorded in the *Journal of Gas Lighting*, in 1852. They distinctly show that the better the coal gas for illuminating purposes the better also for heating purposes, thus the calorific power of what would now be called sixteen candle gas was 650 heat units, whereas that of a 20-candle gas was 750. It is quite evident, therefore, that a good sixteen candle coal gas, selling at two dollars per thousand, would be worth more as a fuel than a non-illuminating coal gas selling at one dollar, if it had a calorific power only equal to that of a mixture of equal parts of hydrogen and carbonic oxide which would have a calorific power of but 324.5 heat units.

Not only so, but all of the plant from the works to the consumer's burner or apparatus would have to be much larger, and would, of course, require a greater expenditure, if a gas with comparatively low heating power was distributed under the same conditions of supply that obtain with ordinary illuminating gas. It may be assumed that the larger quantity sold of the low grade gas would reduce the interest charges so that they would be no greater, on the cost per thousand cubic feet, in one case than the other. But it is well to bear in mind, if this be so, and admitting that the interest and distributing charges are about the same for any gas however made, that the only saving can arise in the cost of placing gas in the holder. But this is not a strong point against the gas now generally made, as this cost is being reduced every year, and there is every reason to believe that, in the not very distant future, by the adoption of improvements, and with the increasing value of residuals, with us, as with those in other lands, this cost will either disappear or become very small indeed.

MEETING OF THE ASSOCIATION OF FRENCH GAS ENGINEERS AT NANTES.

We have just received an account, in the *Journal des Usines a Gaz*, of a most successful and largely attended meeting of the Societe Technique de L'Industrie du Gaz, held at Nantes, on the 13th, 14th, and 15th of June.

This Association now contains 367 members, and its prospective prosperity and influence can be estimated somewhat by what it has already accomplished. It contains as members the leading gas engineers in France who take a most active part in furthering its interests.

There is merely time now to state that the address of the President, M. A. Ellissen, was most admirable, and was eagerly received by the members. It covered what are now the most important points to the gas interest, including an account of the recent great advances made in the art of gas making and distribution. He considered the gas furnace, the mechanical charger, the separate manufacture of heating and illuminating gas, the great improvements in gas burners, the more recent of the Siemens type being exhibited on a grand scale in illuminating the city of Nantes, the improvements in apparatus for heating and cooking, the gas engine, and the need of removing the products of combustion.

The following papers were awarded prizes:

1st. Memoir on "Gas Meters," by M. Salanson.

2d. Memoir on "Laying Gas Mains, and the Means for Discovering and Repairing Leaks," by M. Oppenheim.

3d. Memoir on "The Utilization of Heat in Furnaces for Distilling Coal," by M. Melon.

4th. Memoir on "The Ventilation by Gas of Tenements," by M. Fessard.

Over 40 other interesting papers or communications were read or presented to some of which we hope to refer hereafter.

Among the pleasant incidents of the meeting was the election, as an Honorary Member of the Society, of our friend Major G. Warren Dresser, for which we congratulate both him and the Society.

Measures for The Prevention of Fire in Theaters.

Since the burning of the theater at Nice, new and stringent regulations, aiming at the suppression of all danger of fires in places of public amusement, have been issued from the prefectures of police of many Continental towns.

In Paris a Commission was appointed by the Prefect shortly after this occurrence, and, as a result of the recent report of this Commission, an order is about to be issued to the managers of all the Paris theaters for the adoption of certain measures calculated to lessen the probabilities of fire, to assure the presence of prompt aid in case of an outbreak, and to facilitate the emptying of the buildings in the shortest possible time. The preventive measures comprise stipulations concerning the situation and construction of the building itself, and also the means of lighting, decorations, etc. With reference to the lighting it is remarked in the report that to this is due the greater part of the fires to which all theaters have been so conspicuously liable. Therefore, the gas fittings for lighting the passages and lobbies, the auditorium, and the stage, are subjected to precise regulations. It is to be recollected that at Nice the gas was suddenly extinguished; and had it not been for the darkness thus caused, and which terrified the spectators, a number of the victims might have escaped.

To avoid this great inconvenience, the Prefect's regulations prescribe that henceforth, during every performance in all parts of the building accessible to the public, there shall be maintained alight a sufficient number of oil lamps to enable the public, on an emergency, to find a way through the various exit passages.

Besides this, the auditorium, stage and passages are to be supplied with gas through separate services and meters, so that the sudden extinction of the lights in all parts of the building shall be rendered improbable. All service and internal gas pipes are ordered to be of iron barrel, to the entire exclusion of lead and composition. The footlights are to burn with flames directed downwards into a suitable flue, and, like all other lights fixed near the floor, are to be protected with wire netting.

Various other directions respecting water supply, etc., are set forth in detail in the order, as printed in the *Temps*, including a regulation to the effect that the conducting wires of electric lamps are to be insulated with an uninflammable substance, because accidental rupture of or damages to these wires might result in a local development of heat sufficient to fire a light and inflammable body, and so form the commencement of a conflagration. —*Journal of Gas Lighting.*

Freak of Lightning.

During a severe thunderstorm which prevailed in New York City, and vicinity, on Wednesday, July 13th, the electric fluid cut up some strange antics.

In the town of Flatbush (a suburb of the city of Brooklyn) the lightning struck a lantern frame on top of an ordinary cast iron post, completely demolishing the frame and causing no injury whatever to the post or the service pipe contained therein. The electric current entered the earth a few yards from the post, leaving behind a tube-shaped cavity of some three feet in depth, and four inches in diameter.

Wheeling (West Va.) Gas Light Company.

The Trustees of the gas works of the city of Wheeling have recommended to the Mayor and Common Council of that place that the price of gas be reduced to one dollar per thousand cubic feet, subject to a discount of ten per cent. if the bills be paid at the office of the company on or before the tenth day of the month in which they become due.

The gas made in the year 1880, as shown by station meter, amounted to 58,226,600 cubic feet, which shows an increase of nearly five millions cubic feet over the production in 1879. Mr. Harry Caldwell still remains secretary of the company.

Safety in Coal Mining.

The work of taking down the stoppages in the Maudlin seam at the New Seaham Colliery, where a disastrous explosion occurred in September last, was recently commenced.

It will be remembered that this seam was shut off, from indications of fire being observed during the explorations, and that 28 bodies in the same seam were entombed at the same time. Great progress was made with the operations. A quantity of foul gas was met with, but was gradually drawn off and fresh air courses established.

The explorations are being carried out with the use of the Fleuss patent gas and diving apparatus, and the Fleuss patent lime light lamp. By the aid of the former, workmen are enabled to proceed into the midst of bad gas and carry on their operations as simply as though they were working in the open air.

Ordinary pit lamps can only be carried a short distance in the re-opened pit workings, but the Fleuss lamp can be carried into the most dangerous parts. The practical test to which these ingenious instruments are now being put is watched with great interest by mining engineers generally.—London *Mining Journal*.

[From the London "Journal of Gas Lighting."]

On the Treatment of Gas in Condensation, as Effected by St. John's Apparatus.

By Mr. R. P. Spice.

[Read at the Eighteenth Annual Meeting of the British Association of Gas Managers, held at Birmingham.]

The invention to which I invite your attention is one having for its object that which we all aim in effecting in one way or another—namely, the increased economy of the retort house, by so treating the gas as it leaves the retorts that the effect may be a greater yield, per ton of coal, of gas of a higher illuminating power, without promoting the formation of naphthaline.

The process devised by Mr. St. John, of New York, is an extremely simple one, and consists of an arrangement of rectangular boxes, with external connections and internal dip-pipes, the superficial area of each set or series of the latter being equal to the area of the former; the "dip" or seal in each box being regulated by valves or taps, which control the current of tar and liquor as it flows continuously through the entire series of boxes.

The gas, tar, and liquor, as driven from the retorts, being conducted from the retort house into the first box of the series, is made to pass through the whole, and afterward the gas passes through vertical boxes to effect condensation, and thence, as may be desired, through scrubbers, for the purpose of arresting ammonia in the usual way.

This being the process, the question is—What is the effect? Having watched it in operation, and compared effects and causes, with as much regard to accuracy as the recorded facts at the Rochdale Corporation Gas Works have enabled me, I have arrived at the following conclusions concerning the working of the two years 1878 and 1881; and my reasons for dealing with these two years are, that the year ending March 25, 1878, was the last in which the working was conducted without any aid from St. John's apparatus, and that ending March 25, 1881, was the first throughout which all the gas was passed through the apparatus, while in the two intervening years the process was only partially in use. The following are the facts:

Gas made in	1881	265,736,000 feet.
	1878	245,043,000 "
Increase in 1881 over	1878	20,693,000 "
Make per ton of coal and cannel in	1881	10,211 "
	1878	9,438 "
Increased production per ton	1881	773 "
Cannel carbonized in	1878	7,508 tons.
	1881	3,630 "
Less cannel in 1881 than in	1878	3,878 "
Coal carbonized in	1878	18,453 "
	1881	22,393 "
Excess of coal used over	1878	3,940 "
Coal and cannel carbonized in	1881	26,023 "
	1878	25,961 "
Increase of quantity carbonized in	1881	62 "

Average cost per ton of cannel in the four years ending March 25, 1881	£0	19	10
Average cost per ton of coal for the same year	0	11	8½
Cannel carbonized in 1878, 7,508 tons, the average price being 19s. 10d.	£7,445	8	8
Coal carbonized in 1878, 18,453 tons, the average price being 11s. 8½d.	10,802	7	4½
Total	£18,247	16	0½
Cannel carbonized in 1881, 3,630 tons, the average price being 19s. 10d.	£3,590	15	0
Coal carbonized in 1881, 22,393 tons, the average price being 11s. 8½d.	13,108	14	0
Total cost of coal and cannel in 1881	£16,699	9	0
The cost of coal and cannel in 1878 being on the average of four years	£18,247	16	0
And the cost in 1881, at the same rates	16,699	9	0
The difference is the saving in cost effected by reducing the proportion of cannel required to maintain the same standard of illuminating power	£1,548	7	0

This comparative statement does not, however, give more than a small part of the total sum of advantages realized in the year 1881 by means of the apparatus. To exhibit this in its entirety I propose to refer to the financial account given in the statistics published by the Corporation, which are furnished as an appendix to this paper.

The profit of the year 1881 is stated at	£11,331	8	4
That of the year 1878 at	8,622	9	2
The apparent difference being an increase of	£2,708	19	2

But before the profit of 1881 was struck the account was debited with an additional payment of £236 1s. 3d. for interest and an extra payment of £400 toward the sinking and depreciation funds, besides which £900 less was charged for public lighting, and 3d. per 1,000 feet less was charged for gas supplied to private consumers in 1881 than in 1878; and, to put the two years on all fours, these corrections must be made, viz.:

Excess paid for interest	£236	14	3			
Excess debited to sinking and depreciation funds	400	0	0			
Less charged for public lighting	900	0	0			
Less charged private consumers	2,743	12	0			
				4,280	6	3
Increase on 1881 over 1878				£6,989	5	5
Subject to a reduction on account of the advantage due to the less amount paid per ton for coal and cannel in the latter year, amounting to not more than £1,000				1,000	0	0
				£5,989	5	5

This increased economy, amounting in money value to 6d. per 1,000 feet on the 219 million feet of gas sold in the year to private consumers, is attributable to the very gradual condensation effected by so passing it through the warm tar and liquor, on its way to the scrubbers and purifiers, that all the valuable light-giving compounds contained in the hydrocarbons separated from the coal in the retorts, are taken up by and become chemically incorporated with the gas, instead of being thrown down, as they too commonly are by our older methods of condensation, finding their way, as they do, partly by gravitation, into the tar and liquor tanks, or settling, in the still more objectionable form of naphthaline, into various parts of the plant beyond the exhauster, occasioning serious inconvenience, expense and loss.

This evil commonly extends beyond the gas works into the distributory plant, occasioning thereby trouble and annoyance to consumers, obliging them to complain and to send for the "gas man" to clear the service pipes by using the familiar "service cleanser." It is, perhaps, not saying too much, to refer to this as being the curse of modern gas manufacture, and to describe the product as valuable matter wasted by being put into the wrong place.

If the use of this apparatus did no more than enable us to work at

economically high heats without causing, as such heats unquestionably do, the inconvenience and loss due to the formation and deposit of naphthaline, it would be well worthy of our consideration; but as it has been proved beyond question that by its use a large percentage of cannel is dispensed with in the production of 18-candle gas, and the commercial result is to bring to the credit side of our balance sheets, for the benefit of shareholders, ratepaying proprietors, and consumers alike, a large addition to profit, enabling us to reduce the selling price while maintaining or increasing illuminating power and purity, it behoves us to see to it that such benefits are largely secured for the common good.

[Appendix.]

Statistics of the Rochdale Gas Works, as Published by the Corporation.

	From Mar. 25, 1877, to Mar. 25, 1878.	From Mar. 25, 1878, to Mar. 25, 1879.	From Mar. 25, 1879, to Mar. 25, 1880.	From Mar. 25, 1880, to Mar. 25, 1881.
Receipts.				
Gas sold to private consumers	£38,266 19 7½	£38,237 2 3½	£38,865 0 9	£40,148 10 2
Gas supplied to public lamps	4,970 16 4	4,369 1 8	4,391 10 0	4,070 15 1
Tar and ammoniacal liquor	3,227 13 8½	3,017 11 2	3,082 17 1	3,320 5 4
Coke	2,643 8 4	2,507 14 8	2,184 16 5	2,719 13 10½
Sundries	168 6 11	80 0 0	24 14 3	51 14 5
	£49,277 4 11	£48,211 9 9½	£48,548 18 6	£50,310 18 10½
Expenditures.				
Cannel and coal used	£19,034 7 7	£17,366 10 8½	£15,980 1 4½	£16,382 13 1½
Lime used	160 19 11½	166 3 3	7,195 9 0	.....
Salaries and wages	7,945 16 11½	7,640 19 11½	4,544 3 3	7,362 6 4
Expended on works, etc.	2,914 2 8½	3,688 18 6½	122 8 0	3,129 1 2
Printing and stationery	174 18 3	144 8 1	7,242 0 8	156 11 4
Interest of money	7,045 15 3	7,291 17 0	1,789 18 3	7,282 9 6
Rates and taxes	1,223 17 3	1,346 4 1	385 13 7	2,027 15 7
Rent of land	161 14 1	160 6 11	.....	245 9 10
1-75th of money borrowed paid to sinking and depreciation funds	1,993 3 8	2,393 3 8	2,393 3 8	2,393 3 8
	£40,654 15 8½	£40,192 12 2½	£39,662 17 9½	£38,979 10 6½
Profit this year	8,622 9 2½	8,018 17 7	8,886 0 8½	11,331 8 4
	£49,277 4 11	£48,211 9 9½	£48,548 18 6	£50,310 18 10½

Discussion.

Mr. J. West (Manchester) asked what was the best temperature for the gas to enter the apparatus, and again at what temperature it came out. The principal merit of the apparatus, it appeared to him, was to get rid of all the tar, so that no naphthaline should be formed.

Mr. W. Carr (Halifax) said it seemed to him that Mr. Spice claimed for this process three things—first, that it produced a large credit balance which could be used in reduction of price; second, that it increased the illuminating power of the gas; and third, that it prevented the deposit of naphthaline. These were three very important matters, and if the apparatus would do all that was claimed for it there could be no doubt about the advisability of adopting it. Still, he thought that Mr. Spice had hardly proved his case in the paper he had just read. The particulars given, although very good as far as they went, were hardly sufficient to demonstrate that the improvement in the results at Rochdale was owing to the application of this particular apparatus. It might be fairly admitted that it did increase the illuminating power, and though at first he was skeptical on this point, he had satisfied himself that it did really do so; but with regard to the other two matters he was by no means satisfied. He did not know whether the increase of illuminating power was not obtained more or less at the expense of the tar used in the apparatus. He knew that, at the time it was at work at Rochdale, a great improvement was going on in the management from year to year, and probably if they looked over the balance sheets of 1877 and 1878—before the apparatus was put up—they would find that the same improvement had taken place between these two years. They also knew, as had been pointed out in the President's address, that considerable improvement had been going on over the same years in other works; so they might as well say that the improvement which had taken place in the balance sheet at Leeds from year to year was due to the absence of the St. John apparatus, as to say that the improvement at Rochdale was altogether due to its presence. Much of the advantage gained at Rochdale was due to the fact that the management altogether had improved. He knew that the make of gas per mouthpiece had increased from something like 4,000 to about 6,000 cubic feet during these years, which in itself would put something to the credit side of the balance sheet. As to the naphthaline, he did not know what to say about it. They were always more or less at a loss to know the laws which governed the formation and deposit of naphthaline. He knew works where the St. John apparatus was not used, where they were as free from naphthatine as they were in works where it was used; whereas there were others which were more or less troubled with it. His own experience had been that the trouble did not increase with any increased temperature of distillation, for when he worked low heats he had more trouble with naphthaline than when he worked high. He did not say that the higher heats were the cause of the reduction, for he must confess that he was unable to account for it in any way; but he could not accept the statement that because they were not troubled with naphthaline at Rochdale it necessarily followed that it was because they used the St. John apparatus.

Mr. G. E. Stevenson (Peterborough) said from Mr. Carr's remarks he judged that during the last few years there had been an increase in the temperature of the retorts at Rochdale, and he understood Mr. Spice to say that with the St. John apparatus it was possible to work the retorts at a high heat, and at the same time produce gas of good illuminating power. Would Mr. Spice be so good as to say what was the reduction in the percentage of cannel used in the last year for which he gave the figures—viz., 1881—in comparison with the year 1878, before the apparatus was put up. He should also be glad to know what increase of illuminating power took place, or was there an increased make of gas with the same illuminating power as previously? The question was a very important one—whether the St. John apparatus enabled gas of high illuminating power to be produced, and at the same time a larger quantity to be obtained per ton of coal carbonized. The increase in the make per ton—viz., 773 feet—was greater than the 500 feet over which a discussion took place a few months ago. He did not understand very clearly the construction of the apparatus, or the principle on which it acted, and he should be pleased if Mr. Spice would say whether the heat of the tar was maintained artificially, or did the

hot gas itself heat the tar and take from it the hydrocarbons with which the gas became charged?

Mr. T. O. Paterson (Birkenhead) said that his experience of the St. John apparatus at Rochdale was perhaps the first in this country, and he might say that although he did not find it carried out to the letter everything which the patentees claimed for it, yet the result was so far satisfactory as to induce the corporation of that town to purchase the apparatus. It was said that they were to have a very considerable increase in the yield of gas per ton of coal carbonized, which, however, did not, to his knowledge, result. The increase in illuminating power, however, was quite up to, and indeed better than was claimed by the patentees. When working without the apparatus during the winter months, they used about 33 per cent. of cannel, but during the time the apparatus was being used the percentage was reduced more than one-half, or down to 15 per cent., whilst at the same time the quality of gas was fully maintained. As to the utility of the apparatus as a condenser, he considered it acted more as a carburetter and a washer than as a condenser. The tarry matter was thoroughly washed out of the gas during its course through the apparatus, and the temperature of the tar at the inlet being maintained at 120 to 130 degrees F., it was quite possible to secure an increase of 1½ to 2 candles in illuminating power.

Mr. R. Morton (London Gas Company) said that it would be interesting to know what would be the result of using this apparatus where gas was made without cannel. At Rochdale cannel was used, and it was well known that tars from cannel and from common coals differed very materially; so that whilst gas might be able to take up illuminating power from cannel tar, he was afraid that the tar resulting from common coal, or with a very small percentage of cannel, would not have the same effect. It would be interesting to know, therefore, whether the apparatus had been applied where common gas only was made.

Mr. C. E. Botley (Wormwood Scrubbs, etc.) wished to ask Mr. Spice in what position he recommended the apparatus to be placed—immediately after the hydraulic main, or in conjunction with the horizontal main? With regard to temperature, Mr. Paterson said that from 120° to 130° F. was the most favorable temperature for taking up hydrocarbons, and he would like to ask whether the same result would not be arrived at by carrying the gas in contact with the warm tar around the building. The plan he had adopted, on leaving the hydraulic main, was to take the heavy tar off in one direction to the tar well, and conduct the gas round the buildings in contact with the lighter tar, so that it might take up the lighter hydrocarbons in its passage? Was it the particles of gas being brought into violent contact with the particles of tar in the same way as in the Pelouze and Audouin condenser that produced the advantages that were claimed for the St. John apparatus?

Mr. Henry Woodall (Leeds) asked if there were any difference in the mode of purification employed—whether oxide was used at one time and lime at another; or whether within the period referred to more efficient apparatus had been erected for taking out the carbonic acid in any way, because the taking out of this impurity would naturally have a great influence on the quality of the gas.

Mr. Denny Lane (Cork) thought it was a pity that a diagram of the apparatus was not exhibited, as it was a novelty. He thought that the arrangements for condensation in gas works had not been carried out in as thorough and scientific a manner as some other departments of gas manufacture. He had rarely seen any automatic regulation of condensation in gas works; but, if consideration were given to the number of changes that took place from the presence in combination of gas and tar, it was surely high time that there should be some definite method laid down for conducting the condensation. In former times Mr. Lewis Thompson explained the presence of napthaline in some cases and its absence in others in this way: He said that naphthaline was likely to occur in very cold or very hot weather, but not at other times; and the way in which he endeavored to account for it was this: He said that certain hydrocarbons passed over when there was a moderate temperature, and that they were sufficient to keep the naphthaline in solution. At a very low temperature these hydrocarbons did not pass over, but were carried down in the condenser, and thus the naphthaline, not having the hydrocarbon to keep it in a state of solution, was deposited in the mains. On the other hand, when there was a very high temperature in the condenser, the result was that a larger portion of naphthaline was carried forward than there was of solvent to suspend it. He (Mr. Lane) should be glad to know if these views were still entertained, for if so they pointed to what he had already remarked—that it was highly desirable they should ascertain the best conditions of condensation, and that these should be maintained under a system which would be practically automatic.

Mr. H. Cockey (Frome) regretted that he had only been able to hear the paper indistinctly, but he gathered the general facts stated and the advantages said to be derived from the use of the apparatus. These he took to be an increased quantity of produce from the coal, higher illuminating power, and absence of naphthaline. He could not say anything about the produce, because he did not hear enough of the figures to gather what the results were, but as to the illuminating power, it struck him that there was nothing very particular in the figures quoted. He had himself, on a small scale—manufacturing something under 30 million feet per annum—in former years found that if the illuminating power were to be kept up, even to 14 or 15 candles, it was necessary to introduce a great deal of cannel; but for the last two or three years there had not been a particle of cannel used, and they had been able to keep the standard up to 17 candles. Then as to the naphthaline, by the introduction of higher heats and a more regular means of condensation, they had been able to do away with it entirely. He attributed this to the regular and gradual condensation. A short time since he saw the venerable manager of the works at Brighton, Mr. Ruster, who, by introducing the same kind of gradual condensation, had been able to do away entirely, or except in an infinitesimal degree, with the naphthaline, which a few years ago troubled him excessively. It struck him, therefore, that they required some more proof than they had yet had that all the results attributed to the agency of the St. John apparatus were derivable from it.

Mr. C. Gandon (Crystal Palace District Gas Company) asked Mr. Spice if he did not consider that the action of the St. John apparatus was somewhat similar to that of Mr. Young's analyzer, because, as he understood, in both instances the gas and tar were kept together for some time in a hot state. The suggestion thrown out by Mr. Morton—whether the benefit derived was not chiefly to be expected in the case of gas of high illuminating power—was of some importance. With regard to naphthaline, there was no doubt that the higher the illuminating power of the gas the less likelihood was there of a deposit of naphthaline. With 14 to 16 candle gas there was no doubt an advantage by keeping it in contact with the tar, so long as the two were hot; but if they came in contact when cold, the very opposite would be the result, and there would be a decrease instead of an increase of illuminating power. Whether the increase due to the contact between the hot gas and tar was altogether permanent was a matter of some doubt, on which he had not been able thoroughly to satisfy himself; but he certainly thought that keeping the gas and tar in contact in a hot state was a move in the right direction.

Mr. R. O. Paterson (Cheltenham) said that some of the figures Mr. Spice had given struck him as rather remarkable. He made out that the net advantage of the St. John apparatus was a money gain of £5,900 per annum at Rochdale, and, working this out per 1,000 feet of gas, it came to 6d. per 1000. This is followed by a statement that the advantage was obtained by preventing the hydrocarbons, which usually went to the tar well, from going there, and retaining them in the gas. If this was the main advantage of the apparatus, and the large amount of 6d. per 1,000 feet was gained, assuming that 10,000 feet of gas was made per ton of coal carbonized, it was equivalent to deriving the enormous advantage of 5s. per ton of coal from the use of the apparatus; in other words, taking 5s. per ton of coal out of the tar well and putting it into the gas. He was not aware of any one deriving such a revenue as this from tar, even with rich dydrocarbons in it. On the general question he thought the statement made by his brother had considerable weight; for, in judging of the value of the apparatus, one year should not be compared with another simply, because the conditions might vary so enormously in the two years. The comparative trials to which his brother referred gave this as the net result—that comparatively little was gained in the amount of gas yielded per ton, but there was a decided improvement in the illuminating power of the gas up to an extent of 1½ candles, which appeared to be about the fair maximum value of the apparatus. It was also claimed for it that it prevented the deposit of naphthaline; but this he presumed could only mean that it did not promote the formation of it, and it must leave them, in the long run, very much as good managed works were at present in this respect. He would be glad to have Mr. Spice's explanation of the figures he had quoted from the paper.

Mr. A. C. Fraser (Bolton) said that a few years ago he had some little experience in making gas without any cannel whatever, and with only ordinary coal produced gas of 20-candle power; but the tar produced at the low temperature—about 1700° F.—was so valuable that it readily fetched 6d. a gallon, whereas ordinary tar was then only worth ¾d. to 1d.

Mr. H. Townsend (Bradford) said that one of the chief advantages claimed for the St. John apparatus was the prevention of the deposit of naphthaline; but, as Mr. Carr had said, there were works where naphthaline was unknown, even where the apparatus was not used. He happened to be connected with a works where this was, happily, the case, for since he had been at Bradford he had not had the pleasure of seeing his old friend "naphthaline" in any form. The engineer, too, who had directed these works for a great many years told him that it was quite out of his experience; in fact, one of the pleasures he had looked forward to in connection with this meeting was to renew his acquaintance with his old friend. The cause of the absence of naphthaline was a very gradual reduction in the temperature;

the tar was taken direct from the hydraulic main, and afterward the gas passed through a breaker, which effected the mechanical deposition of most of the remaining portion of the tar. They always aimed at not reducing the gas to a lower temperature than 60° F. at the outlet of the condenser.

Mr. C. Eastwood (Dewsbury) said he would like to know the selling price of the tar at Rochdale in 1878 and 1881.

Mr. J. Chew (Blackpool) said he had listened attentively to both the paper and the discussion, but unfortunately he could not hear distinctly all the figures in the paper. Certainly Mr. Spice had made some rather startling assertions, and, as far as he (Mr. Chew) understood, he claimed a gain of something like 6d. per 1,000 feet by the use of the St. John apparatus. If this was so it was an immense advance on what anybody had done before, and it occurred to him, on hearing this statement, to ask Mr. Spice where the increase of illuminating power came from. He was under the impression, rightly or wrongly, that the gain was to be derived from taking the gas at the right temperature, and passing it through the tar previously made from the same gas. If he were wrong, Mr. Spice would correct him; but if this were the case he would find that not more than three-fourths of a candle, or one at the outside, could possible be gained from the tar deposit, even in the tar well manipulated upon by some of the highest authorities; and if the gas was first to drop the tar and then take it up again, he could not see that there was such a great gain after all. As had been remarked, the value of the tar robbed of the light oils and naphthas was very much decreased, and the tar distiller would certainly not give the same price for it after all the light oils were taken from it as he did before. It was only a valuable commodity to him in proportion to the light oils in it. If a tar distiller found that he could get 20 gallons of light oil from tar distilled in any particular works, he would give a certain price for it; but if at another works gas was manufactured in such a manner that all the possible light oils were taken from it, it would be found that not more than 7, 8, or 9 gallons of light oil could possibly be obtained from a ton of tar, and he would not give as much for it. His (Mr. Chew's) own experience was that where low heats and plenty of cannel were used, a tar rich in light oil and naphtha was produced; but, on the other hand, where there were good sharp heats and common coal was used, there was not much, if anything, left in the tar that the gas was capable of carrying to the consumers' meters.

Mr. Corbet Woodall said, like many others, he labored under the disadvantage of not hearing the paper very distinctly; but what he gathered, as much from the discussion as from the paper, brought him to the conclusion that there was something inherently wrong in the manner in which the particulars upon which the paper was based had been laid before the Association. The inexorable logic of the balance sheet did not apply to such a case as this, and he entirely agreed with the remarks just made by Mr. Chew, that in order to form an estimate of the value of such an apparatus as that dealt with in the paper, it was desirable that experiments should be made with it and without it, as nearly together as possible; both the materials used and the methods of investigation being the same in each case. As it was, so far as he could gather, they had in this case only the comparison of the balance sheet and that of the illuminating power of the gas in different years. As almost everyone who had spoken had suggested, there were so many circumstances which might influence both the one and the other, that it was impossible to arrive at anything like a conclusion as to the absolute value of the apparatus from any such figures. It had just been suggested to him that the value of 18-candle gas delivered into the holder in Yorkshire was from 7d. to 8d. per thousand feet; and if this were so in a works where the St. John apparatus was not used, it would be interesting to know what was anticipated would be the value where it was in use, and whether or not they were speedily to have realized the condition which the Mayor had referred to that morning. Mr. Morton asked whether this apparatus had been used with common coal, which led him (Mr. Woodall) to speak of his own experience with it. Shortly after it was introduced he had an opportunity of making a trial at the Phœnix Gas Works, Vauxhall, and the result was that the gain in illuminating power was so slight that he was not disposed to recommend its use. He was bound, however, to say that the method on which the experiment was conducted—owing to the manner in which the apparatus was fitted up—was unsatisfactory in itself; and therefore he would rather not name the exact results obtained in these trials. His main object in rising to speak was to suggest that this paper and discussion pointed out the wisdom of the resolution passed that morning—to encourage more direct and exact methods of investigation both into new processes proposed to be applied to manufacture, and into those difficult and doubtful questions which were raised as to the results obtained by one method or another.

Mr. F. W. Hartley begged to remind the members of a most interesting paper which was contributed some time ago by Mr. Leicester Greville to the *Journal of Gas Lighting*. Those disposed to consider this subject fully might, with the assistance of Mr. Greville's paper, be able to judge how far their tar was likely to be depreciated in value by the application of the St. John apparatus. Mr. Greville showed that the gas was enriched immensely by a very small addition of naphtha, which could be obtained sometimes from coal tar. The hydrocarbons contained in common coal gas, and which gave light, were not more than 4 per cent.; and thus it could be easily understood that a very slight addition of light naphtha or benzole vapor would considerably increase the illuminating power.

Mr. T. Newbigging (Manchester) said they were much obliged to Mr. Spice for bringing this matter forward, although most present would agree that he had presented it perhaps in a rather exaggerated form; but he (Mr. Newbigging) was sure, from the discussion that had arisen, they would all derive much benefit from the paper that had been read. There was one point which he should not like to be overlooked with respect to comparing the illuminating power of gas at the present day with what it was some years ago. In some gas works the proportion of cannel used had been materially reduced within the past five or six years, and this was due not only to improved methods of condensation and purification, but very much (perhaps the greatest proportion) of the advantage must be ascribed to the improved gas burners produced by Mr. Sugg and others. Within the last five or six years gas burners had been improved to such an extent that the illuminating power of gas had been developed from 17 to 22 per cent., and this fact in itself largely accounted for the very material reduction which had taken place in the proportion of cannel necessary to be used in its production.

Mr. W. Sugg said it was important to bear in mind that the illuminating power of the gas in the towns from which the members came, who took part in the discussion, was not always mentioned, and this was an important omission. It was almost invariably the case that where the gas was of a quality between 17 and 18 candles, naphthaline was nearly unknown; but where from 14 to 16 candle gas had to be supplied, there was some difficulty in keeping naphthaline from depositing. There was no doubt, from the knowledge he had acquired, not so much from practical working—and therefore he spoke with some diffidence—as from information obtained from various works which he had visited, that where condensation was carried on very slowly, and the heat was brought down very regularly and gently, and never went down to a very low point, there was less trouble with naphthaline than where sudden changes or chills came on the condensing apparatus. Take the case of the old City of London Gas Works, when under the direction of Mr. Mann. Even at a time when the illuminating power of the gas was not so high as it was now, he had no trouble with naphthaline, because he adopted the process of carrying the cooling main round the retort house, and brought the gas slowly down to the ordinary temperature of the atmosphere, but never below it. As to the alteration of the standard of illuminating power owing to the use of improved burners, there was no doubt that some years ago, when the illuminating power of gas was first taken, there was no standard burner for the purpose of testing it, and people used different kinds. But, besides this, the apparatus used with the burners had been essentially improved, and a different mode of using the candles had been introduced. At the present time they were dealing with very careful methods, where a large number of errors had been eliminated. In the old times he had seen photometers put up close to walls where there was a great deal of reflection, but they had had now for a good many years a body called the Metropolitan Gas Referees, who had given very great attention to improving these matters, and who had entirely eliminated all possibility of reflection from the improved apparatus for testing now in use, and their action had not only influenced London, but every city in the kingdom.

Mr. Spice, in reply, said he did not imagine that so many questions would have arisen with regard to the paper. His idea was that members would be surprised that he would have ventured to make such startling assertions; but he proposed to refer them all to Rochdale, and let them examine the facts for themselves, and if they did this it would confirm all he had said. He was not there as the exponent of a favorite system, nor with any ulterior object; he was there as one of themselves, to bring before them facts worth taking note of and examining into. He had been at Rochdale and carefully inquired into this matter, and he had not learned that the great financial results he had mentioned had been, in any important measure, due to other improvements which had been introduced at the works while these experiments were going on. Guided solely by the facts he had ascertained, and by the statistical statements published by the Rochdale Corporation, extending over four years, he had given, in a condensed form, the actual results, and he defied any gentlemen present to show that the conclusions he had arrived at were not based on the facts published by the Corporation. Some gentleman incidentally asked what might be expected if 6d. could be saved out of 8d. He had not come before them with any conjuror's trick of this kind, but with a statement of facts realized at a particular works. In round numbers, 7,000 tons of cannel were formerly used, and 3,500 tons now sufficed to produce the same results. The illuminating power of the gas was not lowered but raised. For 1878 it was 17.91 candles;

in the year following it was 18.23, when the apparatus was partially used; in the next year, when it was also only partially used, it was 18.21; and in the year ending the 25th of March, 1881, it was 18.13, or 0.22 candle higher than in 1878. Besides this, with only 62 tons more coal used, 20,693,000 cubic feet more gas were made. This was due to working at higher heats and keeping the coal a longer time under the operation of distillation. So much more gas was obtained from the same quantity, practically, of raw material; the raw material being less rich in illuminating power than that which was used in 1878. It was not that this money would have gone into the tar well—it would not have gone anywhere—it would not have been created. Some of the rich matter might, and some of it would have gone into the tar; and some, by these high heats, might have taken the form of naphthaline, which meant light-giving power kept from going to the gas-holder and the consumers' burners. As to the imagined deceased value of the tar, the tar and amoniacal liquor in 1878 fetched £3,278 13s. 8½d.; the next year, £3,017 11s. 2d.; the next, £3,082 17s. 1d.; and the next, £3,320 5s. 4d.; so that they had not lost in diminished value of the tar any part of the great gain in gas rental. With regard to the question as to where the apparatus was used where only common coal was employed, he must answer, "Nowhere;" but it was now in course of introduction, and he believed he might say in course of rapid introduction. The advantages in such cases could not be anything like the ones he had portrayed in those works where cannel was used to produce 18-candle gas; but every engineer would say that taking more gas out of a ton of coal, and improving that which he did take out, must result in benefit wherever it was applied, and the precise benefit in each case must be a matter depending upon circumstances. It was not a new trick or a new idea; it was simply following out and more effectually doing that which Mr. Cockey intimated, and which had been suggested three or four years ago—breaking up the tar in its passage from the retorts to the condenser. With regard to condensation, Mr. Denny Lane had touched a point which was worth consideration, and was indeed an essential element—the gradual condensation of the gas. Some twelve months ago he introduced a jet of steam in an inner pipe in the condenser, and had the results of the experiment recorded; and he found that warming up the lower part of the condenser effected an improvement in the illuminating power of the gas to the extent of 0.75 candle; not that the ¾ of a candle was realized just where it was warmed, but after the whole process was completed, and the gas had been stored and sent out to the town. All these things were in the same direction in which Mr. St. John had gone; but Mr. St. John, he ventured to think, had gone further than most or any of them. At all events, he had done so much as to entitle his invention to serious consideration.

The President said that the discussion had been so full and exhaustive that it was not necessary for him to add anything to what had been said. He confessed that he had been a little startled at the figures which Mr. Spice had put forward. As had been very properly remarked, 6d. per 1,000 feet was an extraordinary saving to effect by the process under consideration, as it would almost entirely wipe away the cost of gas manufacture. He was not one of those who thought that they could eat their cake and have it too, and he was not sanguine enough to think that if they made use of the light oils for enriching their gas they would not reduce the value of the tar. What they had to determine was whether the light oil was of more value to them for such a purpose, or as forming a constituent of the tar which they sold to the distiller. He would only add that at the Adderly Street Works of the Birmingham Corporation, a St. John apparatus had been in use for some months, and any member who wished might, by a visit to these works, obtain any information with regard to the apparatus which the officials there were themselves possessed of.

Electricity in the Wrong Place.

The Albany *Journal* records an incident that exhibits this good servant in the character of a bad master. In one corner of Weed, Parsons & Co.'s printing establishment stands the machine that furnishes the electric light for an adjacent store, the power coming from the engine of Weed, Parsons & Co. One feature of the machine is the armature—a wheel containing coils of insulated wire through which the electricity flows in powerful currents when the apparatus is in operation. This armature revolves with terrific velocity, and constitutes a powerful magnet. One day a young man came in and ground a large pair of scissors on an emery wheel near the generator. Turning to go out past the machine, he carried the scissors carelessly in his hand, when they were immediately drawn into the armature, and were soon revolving with it at frightful speed. The young man got out of the way as quickly as possible, and was unhurt. For a few minutes the machine presented a very startling spectacle. The whirling scissors, twisted and broken, but still adhering to the revolving armature, began to cut the wires, and thus broke the electric current, which escaped in streams from the fractured ends of the wires, and in a moment or two that portion of the room was literally filled to the ceiling with whirling lightning. No one dared to approach the machinery for some little time, but the belt was finally thrown off, and the dangerous show was at an end.

[Official Report.—Continued from page 272, Vol. 34.]

Second Annual Meeting of the Central New York Gas Engineers Association.

[Owing to the sudden and severe illness of the Secretary, Mr. C. A. White, of Rochester, the publication of proceedings of the Central New York Gas Engineers' Association has been unavoidably delayed. It gives us pleasure to be able to state that Mr. White has recovered.]

The Association met at two P.M., pursuant to adjournment.

Same members present as at the morning session, also Mr. Avery, of Auburn.

Mr. A. C. Wood, President of the Association, read the following paper on

ELECTRIC LIGHT.

Gentlemen of the Association:—It is a matter of satisfaction that we are able to congratulate ourselves on the continued prosperity of the business in which we are all engaged. Reports from all sections show an increase in the manufacture and sale of gas as compared with other periods, showing that a revival of general business interests promotes an increase in the consumption of gas; and I see no reason why this state of things should not continue with a continued prosperity of the business interests of the country.

The electric light, which threatened at one time to become a competitor of gas lighting, has, I think, so far demonstrated that its ultimate use is limited to certain purposes where a strong light is required and expense is a secondary consideration, and wherever used it will be a promoter and educator of the people for more and better light than they have hitherto enjoyed. Instead of being a competitor, the electric light will enhance the interests of gas companies. That the electric light has been tried and found wanting for street lighting purposes, in many cities in this as well as in foreign countries, has become a matter of history.

Those who witness for the first time the lighting of Broadway, New York city, with the electric light, will be disappointed, for the effect produced is not what was expected from the promises made. The Superintendent of the New York Lamp Department, in a report published in April last, states that the lights were extinguished on several occasions, and says: "The trials thus far made have demonstrated that the electric light can be made available for public illumination, but for permanent street lighting the question of its positive reliability must be carefully considered. All danger of failure must certainly be avoided, for no section of the city can be permitted to be in darkness during any time of the night. In erecting the circuits the wires must be so placed that they will be free from the risks which are liable to overground lines, and they must be located where they cannot be tampered with. Plant in the station must be held in reserve and ready for immediate use, for accidents to the best made machinery will unexpectedly occur. All these things must be accomplished and provided for before the light can be permanently adopted on streets as an illuminating agent to the entire exclusion of gas." "That the streets of our city are inadequately lighted is a fact which must be apparent to every wayfarer. While a 3-foot gas burner may have been ample a half century ago, when our city was not much more than a town, it is quite evident that the light emitted from a burner of that capacity is insufficient for the convenience and comfort of a large commercial metropolis. Hence an improvement in our street lighting is very desirable, and this can readily and surely be accomplished by the substitution of larger burners. This, of course, would involve an increase in the cost of the gas, but it is hardly possible that the electric arc light can compete with gas at the rate now charged by the gas companies for the public lamps of this city."

The cost of the electric light is a mooted question, and a hard one to solve from any data given to the public by the electric light companies; but, from their newspaper accounts of it, it is much cheaper than gas—about as cheap as daylight. The value of any commodity is the price at which it sells on the market, and we find that the electric light companies charge $1 for a single lamp per night up to 12 o'clock, or, say, 6 hours. We also find in the report above referred to that "the 23 electric lights displace about 110 gas lamps on Broadway and side streets," or, say, each electric lamp displaces 5 gas lamps (which would make 115 displaced by the 23 electric lamps), then each electric lamp displaces 3 gas lamps burning 5 feet of gas per hour, and for 6 hours would consume 90 feet of gas, costing 20¼ cents, at $2.25 per 1,000, the price now charged in New York. But the electric light companies claim that the light they charge $1 per night for will give a light equal to 250 candles. This is equal to 14 five-foot burners

of 18-candle gas, consuming in 6 hours 420 cubic feet of gas, which at $2.25 per 1,000 makes 94½ cents. But this 250-candle burner has no doubt been tested and computed by the so-called "French measurement," which is a delusion.

Experience has shown that the electric lamps actually displace 3 gas lamps burning 5 feet of gas per hour; but allow that they give a light equal to double that number, and the cost for gas will be 40½ cents, as against $1, the cost of the electric lamp. This is for the electric arc light, and is about 2½ times the cost of gas.

For the incandescent light, such as is exhibited in many places in New York city, it seems to be more expensive. A large banking house in the city was supplied with these lights. A bill was rendered for the fixtures of $1,100, and for the first two months' use of the light, $560. Their previous bill for gas used for 12 months was $1,100, This is over 3 times the cost of gas.

Accounts of the economy of the electric light that come to us through the newspapers are of a very extravagant nature, but recently our paper gave an account of the introduction of the electric light into two manufacturing establishments, stating that the gas bills of one of the establishments was $100 per month, and that a great saving was to be made by the use of the new light. I informed myself as to the facts, and found that the gas bills of one of the concerns amounted to $74 per year, and the other $280 per year at the present price for gas, and that they had been at an expense of $3,000 in putting the apparatus for the new light into their respective establishments. You can figure for yourselves the gain to be made from this investment.

There can be no question but that the electric light is more expensive than gaslight for the same amount of light, the gas being burned in the ordinary way. Stimulated by the claims and exhibits made of the electric light, great improvements have been made in burners, whereby the value of gas as an illuminating agent has been largely increased, so that at the present time gas can safely compete with electric light both as to cost and amount of light; and, as before remarked, we believe that the electric light will act as an assistant to instead of a competitor with our business. The more and the stronger light that is used, and the greater facilities for obtaining it, the more light will be demanded. This is so in all business. Take for example the transportation of passengers and merchandise. When the elevated roads in New York city first went into operation the value of the stock of the surface roads running in the streets directly beneath them was greatly depressed, and sold for about one-half their former value; but to-day they are worth as much as they were before the elevated roads were built. The reason is obvious. The greater the facilities offered for travel, the more people will avail themselves of them. The great trunk lines of railroads, with the number and facilities for handling merchandise constantly increasing, bring with them a surprisingly large increase in tonnage of goods to be handled.

So, in our business, we have nothing in the electric light to discourage, but everything to encourage us to an increased and continued prosperous business. But due attention must be paid to the economical management of our respective works, so as to lessen the cost of manufacturing and supplying gas to our customers. Secure the most modern and best apparatus for use in your works; purchase the best coals, and get all the gas from them; look well after leaks in the streets; confer with your consumers; obtain for them burners best adapted to consume the gas you furnish; encourage the use of gas stoves and gas engines by furnishing them at cost or at a rental, as may seem best; sell gas to your consumers at a price to make a fair return to your stockholders, remembering that 10 or 12 per cent. dividends expected a few years ago are above the rates now considered as a fair return for such an investment. In short, encourage the burning of gas in all legitimate ways; make a good gas and sell it to your consumers at a fair price, and you have nothing to fear from the electric light.

On motion, a vote of thanks was tendered Mr. Wood for his valuable and interesting paper.

Capt. W. H. White made some very interesting remarks regarding the use of electric light in New York city, and stated that the gas companies had nothing to fear from its use. The street lamps of that city had heretofore been lighted at an expense of $15 per lamp; this year the gas companies were being paid $18 a lamp.

Capt. White then read some statistics regarding the use of gas as fuel for heating and cooking, and the advantage to the consumer by its use, as well as a legitimate return or profit to the companies by the utilization of their mains during the day.

Mr. Slater (Providence) also gave some very interesting points regarding the use of the Brush light in the Riverside Mill of that city, who claimed to save from $14,000 to $20,000 per year from its use. Mr. Slater remarked that he had examined the matter fully, and did not see how they could save that amount when their largest gas bill had never exceeded $10,000 per year. The Mills had been using 5 Brush machines, running 16 lights, for two years, and were now adding two more, or seven in all. One Brush light replaces 6 gas jets, and, running 12 hours, each light would cost $125 per year.

Mr. Avery (Auburn) made some remarks regarding electric light, and said that he was not afraid of it.

Other members of the Association took part in the discussion, which was of rather an informal nature, but all tended to show that the gas companies had only to look closely to their own interests, to fully develop all of their resources both in manufacture and distribution of their product, and had nothing to fear from the electric light as an active competitor.

Mr. W. A. Wood (Syracuse) then read the following paper on

THE USE OF WATER IN ASCENSION PIPES.

A Continuation of the Paper read before the Association Feb. 19, 1880.

The able paper on the subject of stopped standpipes, by Mr. Forstall, of New Orleans, read before the American Gas Light Association, at Chicago, in October last, was so comprehensive and exhaustive that a continuation of the discussion seems little less than presumption.

The experience at New Orleans has only emphasized the fact familiar to us all, that what is a sure remedy in one works does not avail in another. The numerous inquiries made personally and by letter with regard to the details of the appliance have led me to think that my first description was not sufficiently clear, and my apology for this second appearance is a desire to rectify mistakes that may have been made through a lack of clearness in the former statement. I have made a drawing of the apparatus as in use at our works, and I desire it to be distinctly understood that I am not advocating anybody's patent, knowing, as we all do, that there are many patentees of devices for introducing water into standpipes, any and all of whom may think they have a claim on your gratitude and pockets. I have a copy of the drawing for each member present, and will gladly furnish one to any gas man who feels (and who of us has not felt?) how happy he might be if the man who invented stopped standpipes had never been born.

Mr. Forstall, in considering the nature of stoppages, finds three varieties, as follows:

1. "Hard, stratified, graphite-like material, adhering closely to the whole interior surface of the standpipe proper. This accumulates principally above the highest point reached by the cleaning auger used regularly between the charges, and forms the most difficult obstruction to remove.

2. "Thick, pasty, tough pitch, which balls together under the tools and drops out in large lumps. This is most frequent in our works, and is found equally in stand, bridge, and dip pipes, and even in the hydraulic main.

3. "Dry soot or granular lampblack. The stoppages from this material are sudden, and rapidly become total. They occur a short time after the retorts are charged, and may extend as far as the dip pipe. They are very easily removed. Sometimes all three of these characteristic products are found in the same pipe, but generally the nature of the stoppage is determined by the predominance of one or the other of them."

The perusal of this paper was an incentive to a more careful observation of the action of the water and the frequency and character of the stoppages at our own works. A record of the number and nature of the stoppages for six months revealed that they were almost entirely confined to the upper retorts, and were exclusively of the kind classified above as No. 3, viz., dry soot or granular lampblack, which collected just above the mouthpiece shortly after the lid was put on, and yielded readily to the auger, not forming again until a succeeding charge.

The greatest number of stoppages, all of this kind, in any one month, March last, was 12, and during this period the water supply was shut off on three different occasions. One of these days we had 4 stoppages—the largest number recorded in 24 hours for six months.

The material described under No. 1 we are no longer troubled with, and of No. 2—the "thick, pasty, tough pitch," which gave our friend Forstall so much trouble, and is the chief source of all difficulty—I have a beautiful specimen, which I submit for your inspection.

You will see that it is light and porous, having been "raised," as it were, by the imprisoned gas seeking an escape; but you can readily imagine that if allowed to remain in contact with a heated iron surface it would stick and dry and bake until it became a hard graphite-like material. Observation warrants the conclusion that the formation No. 1 is simply No. 2 so dried and baked on the inside of the pipe. The sample before you did not come from the standpipe, but rolled down into the mouthpiece when the lid was removed; and we can see it any day at our works welling out of the standpipe and piling up in the angle of the mouthpiece, to be be scraped off and consigned to its proper place in the dirt pile.

As to the theory of formation and prevention, you will probably all agree that there is nothing of value as an illuminant in this black amorphous product, and that if it is to be converted from its gaseous to its present condition, as at some stage of the condensing process, the sooner it is accom-

plished the better; and that any attempt to carry it along into or beyond the hydraulic will prove a delusion and a snare. It will simply transfer it from the standpipe to a point more difficult of access.

The theory has been advanced that perhaps the action of the water had a cooling effect on the mouthpiece and the standpipe immediately above it, and that these in turn had a cooling effect on the hot vapors, causing the early deposition of the pitch. While granting that such an effect must follow if, as Mr. Forstall states, water were introduced until "it cracked several mouthpieces and the water lay on the retort house floor," this can not be the case when, as with us, the amount is so small that little if any is to be seen dripping from the standpipe when the lid is removed. Nor does it seem possible that so slight a quantity, introduced drop by drop, can have an appreciable effect in reducing the temperature of the rapidly ascending vapors. The pitch was formed before we adopted the water cure, but then it stuck to the sides of the pipe, gradually filling them. It is deposited in the stand pipe now as it was then, but it is not allowed to accumulate.

In this connection a dialogue with the foreman of the Cortland works, to whom we are indebted for the suggestion, may not be uninteresting. When asked what led him to try the plan, he replied—

"You see, I wanted to bail some tar one day, and I took an auld dipper from a pail of wather. Faith, I noticed that where the dipper was wet the tar didn't stick. So, sez I, if the inside av me shtand pipe was wet the tar wouldn't stick; and I put in the water, and, begorra, it didn't stick."

Our New England brethren, who are adepts at hasty-pudding, as they ladle out the thick, pasty, steaming mass to the Yankee gas men of the future, well know that if the spoon is first dipped in milk, the mush will slide off as if skipping a bill for board, leaving the spoon as clean and bright as it was before; but let an ignoramus, unpossessed of this simple secret, attempt to "carve" and, before the first hungry applicant is supplied, he will call for a stand-pipe auger, in the shape of another spoon, to scrape off the fast accumulating deposit. This we believe to be the whole secret; as long as the interior of a large and smooth pipe is moistened with a film of water, or anything else for which the pitch has no affinity, just so long will the accumulation slide down into the mouthpiece. And here is a suggestion that the well known action of petroleum enricher in freeing the pipes may be more mechanical than chemical in its nature. In pipes that have been in use for a long time, and have become more or less obstructed the old deposit may act as an absorbent, and the introduction of the water may not prove effective until the pipes are burned out. But starting with pipes once cleaned and favored with a constant water supply, we have not had a stoppage that amounted to an annoyance since the system was introduced.

A common mistake of those who have tried and pronounced it a failure has been that of carrying the end of the supplying syphon to the center of the stand pipe instead of terminating it flush with the inside surface. In the former case, of course, the water dropped straight through to the mouthpiece and no benefit resulted.

Knowing the inexplicable and contradictory results, under apparently similar conditions, peculiar to our business, we cannot guarantee a cure for all. But with proper care to ensure the thorough moistening of the inner surface of the standpipe for a reasonable distance above the mouthpiece, it passeth understanding why relief should not follow.

Conditions varying with the length, size, and temperature of the pipe may necessitate a variation in the method of application, as the introduction of the water at different elevations, in stand or bridge pipes, or at two points, on opposite sides, in the same pipe.

The variation necessary to meet these conditions each can best determine for himself by experiment.

The discussion on Mr. Wood's paper was quite general; and a number of the members present related their experience, and with the result of doing away with stoppage.

Mr. White, of Rochester, stated that he had used it, and with undoubted success; and could not but believe that, if properly applied, would prove a sure remedy in all cases.

The syphon outlet should be introduced just flush or barely flush with the inside of the stand pipe. The water then entering, drop by drop, would trickle down the inside of the stand pipe and from the heat thereof be vaporized, thus keeping the pipes moist and preventing effectually the adherence of any substance—the natural result would be that any accumulation would drop into the angle of the pipe or in the mouthpiece, from either of which it could be easily removed.

Mr. Kingsbury, of Corning, had tried Mr. Wood's plan, and did not now know what a stopped stand pipe was.

On motion, a vote of thanks was tendered to Mr. W. A. Wood.

Quite a desultory conversation was then indulged in by the members on the subject of gas stoves, and the best method of introducing them, and of inducing consumers to test them as to economy and improvement in cooking.

On motion of Mr. Kingsbury, the naming of the place of next meeting was vested in the President and Secretary.

On motion, the Association then adjourned.

[After the motion to adjourn had been agreed to, the members remained for a short time in informal session, and the following is a truthful account of their deliberations.]

The President now remarked that some two years ago Mr. Slater, of Providence had paid him a visit whilst en route to visit the Holly Steam Heating Apparatus at Lockport. He had seen the gentleman on board the cars to proceed on his journey, but had afterwards heard that a strange incident had befallen him. That, absorbed in the object of his journey, when arriving at the village of Brockport, the brakes-men, in their usual clear tones, called, "Brockport!" rousing my friend from his reveries. He had only been able to distinguish the latter syllable of the word, "port," and not being aware of the fact that there are at least half-a-dozen stations with "port" tacked on for a "hind name," hastily seized his satchel and reached the platform just as the train pulled out. Looking around for a moment, he addressed himself to one of the inhabitants as to the location of the office of the Holly Steam Heating Company, and it was only after several inquiries, addressed to various parties, that he was made aware of the fact that that company's office was in Lockport—just 60 miles further up the road!

Now, on his way to visit us, he took a sleeping car at Worcester, full of hope of a pleasant trip, plenty of money and gold watches; to-day he reaches us shorn of all; a typical emblem of the old proverb, "that riches take unto themselves wings and flee away."

Still, we have our friend Captain White with us—generous to a fault, ever ready to assist a worthy brother in distress, to help him out of any difficulty This makes the matter much easier for us; and as the members of the Association, upon hearing of the misfortunes of their visitor, determined to replace, so far as might be, the loss, I would now call upon Captain White to present the same to Mr. Slater.

Mr. President, and gentlemen of the Association—You could not have asked from me the performance of a more pleasant duty than that to which I am now called—that of relieving a brother gas man in distress. Had he been a Mason, as he should have been, this would not have occurred.

I cannot think of any more beautiful or more touching story in the world's history than that given us in the bible—the story of the good samaritan. Rich in its truthfulness, as exemplified in the world around us, beautiful in the quiet manner of its accomplishment, and grand in its complete fulfillment.

Not only does the story tell us that he lifted him up and dressed his wounds, but that he also placed him upon his own beast and carried him to an inn and there paid for care and nourishment, until he should recover and be able to care for himself. Mr. Slater, to-day is this story renewed again; and I am called upon by these gentlemen to bind up your wounded feelings, to fill your empty purse, to replace the faithful monitor of time which you have lost, and see that no ill befalls you during your further stay among us.

Money for your journey and your needs permit me, sir, to present you in this purse, filled to repletion with the root of all evil; and believe me, sir, that it is of such a nature that it will never be taken away from you.

[Captain White here handed Mr. Slater a purse filled with paper imitations of coins of various denominations.]

I have here a watch, valuable as could be purchased in the city for the money, also a chain and charm, of which we beg your acceptance. It is a railroad watch, one of Howard's best. It is not a railroad watch in the same sense as was yours, that is, purchased to be stolen on the cars, but rather like it in its movements; the one requiring continual steam for motion, your watch requiring continual winding for the same purpose.

Take them, and ever cherish them as a memento of your visit to Auburn.

Mr. Slater responded as follows—

Mr. President, and gentlemen—The remarks of Captain White have disturbed every emotion of my heart. I cannot help it; he has such a gentle and tender way of covering over one's misfortunes, such a quiet way of soothing one's disturbed nerves, and such a hearty and feasible way of bidding one forget the past, and its sorrows, and look forward to brighter and happier hours, that he completely absorbs one's attentions so that one knows not what to say in reply. He has covered the whole ground, and I have only left for me to say, "I thank you." I shall never be in the presence of any association of gas men but what this moment will come vividly before my mind. I shall never see a gas man in distress, be he a Mason or not, but what I shall fly to succor and relieve him.

These tokens shall never pass out of my hands while life shall claim me; but shall be so placed as to be a constant reminder to me of that charity which is above all things.

I am indeed glad to have been with you to-day, and can now only return my most grateful thanks.

[Translated for the AMERICAN GAS LIGHT JOURNAL.]

The Efficiency of Generator Furnaces.

[Continued from page 34.]

We will now consider the second case in which, owing to an insufficient air supply, the combustion of the carbonic oxide is not complete.

Calculation again shows that the probable theoretical composition of the products resulting from the combustion of a generator gas having the given composition, and under this condition of air-supply, is as follows :

Carbonic acid	16.5 per cent.
Carbonic oxide	3.5 "
Nitrogen, etc	80.0 "

which again agrees very closely with that actually observed. Under these circumstances, one cu.m. of generator gas requires for complete combustion 0.0735 of oxygen, or 0.35 cu.m. of air, about one-half of what was consumed in the first case ; hence the volume of the products of combustion is 1.276 cu.m. as against 1.617 cu.m. as before. Hence, every kg. of carbon requires an air supply of 9.33 cu.m.

The operations in the generator proper remain the same as before, since the resultant gas has the same composition. There is, it is true, a difference in the manner in which the distribution of the heat, both to the gas and the air, is effected ; but since this does not enter directly in the calculations for efficiency, it is no longer discussed at present.

Efficiency of Furnace.—When, as is the case in the present instance, there is a deficiency in the air supply, only 0.147 cu.m. of the 0.191 cu.m. of carbonic oxide contained in one cu.m. of generator gas is thoroughly consumed ; at the same time there are developed $0.147 \times 3007 = 442$ heat units ; adding to this the thermal value of the hot generator gas, and of the air supply, which was found above, after making proper allowance for losses, to equal 475 units, we have for the total available heat in 1.276 cu.m. of the gaseous products of combustion, 917 thermal units.

In calculating the initial temperature of these gases, the same method as before can be used, for it must be borne in mind that the carbonic oxide, which now takes the place of the free oxygen in the products of combustion of the first case, has precisely the same specific heat, for equal volumes, as the oxygen. It has, then, already been shown that 0.326 of a heat unit is absorbed in raising one cu.m. of the products of combustion one degree in temperature ; hence, 917 heat units, which are available from combustion of one cu.m. of generator gas, will raise the resultant 1.276 cu.m. of waste gases to a temperature of $917 \div 1.276 \times 0.326 = 2204°C.$

In the second case, therefore, although combustion is incomplete, we have a higher initial temperature owing to the diminished volume of the products of combustion. If the average temperature of the waste gases is 1129°C., they carry off $1129 \times 1.276 \times 0.326 = 470$ heat units, leaving $917 - 470 = 447$ heat units available for carbonizing purposes.

Summarizing these results, as before, we have the following tabular statement of the manner in which, in this instance, the heat was generated and distributed—

I.—*Heat Generated.*

a. In generator, as before	531 units per cu.m. of gas	48.1 per cent.
b. In bench	442 " " "	40.0 "
c. Undeveloped heat	132 " " "	11.9 "
	1105	100

II.—*Distribution of Heat.*

a. Absorbed by bench	447 units per cu.m. of gas	40.5 per cent.
b. Waste furnace gases	470 " " "	42.5 "
c. Loss by incomplete comb'st'n.	132 " " "	11.9 "
d. Loss by radiation	56 " " "	5.1 "
	1105	100
Total heat utilized	447 units per cu.m.	40.5 per cent.
Total heat lost	658 " "	59.5 "
	1105	100

The following comparative table gives the results obtained under the two conditions of air supply—

	I.—Excess of Air.		II.—Deficiency of Air.	
Heat utilized	454 units or 41.1 per ct.		447 units or 40.5 per ct.	
Heat lost—				
a. By waste gases	595 "	53.8 "	470 "	42.5 "
b. Incomplete c'bst'n	—	—	132 "	11.9 "
c. Radiation, c'dut'n.	56 "	5.1 "	56 "	5.1 "

It would thus appear that, in both instances, the efficiency of the furnace is practically the same. The loss of 12 per cent. of the total heat due to incomplete combustion of the carbonic oxide in the latter case is neutralized by the increased volume of the products of combustion when there is an excess of air, the final temperature in both instances being the same. Hence it would seem that the existence in the waste gases of 33 per cent. of free oxygen is an index of quite as great a source of loss as that of 3.5 per cent. of carbonic oxide.

Subsequent numerous observations upon the same furnace, and extending over a period of three months, from October to December, 1879, corroborate, as nearly as can reasonably be expected, the results obtained during the present investigation, and show that the furnace actually was in average working condition. Two additional furnaces were also included in these later investigations, and hence it is justly concluded that the above results represent, in a general way, the efficiency of benches arranged on the Liegel system.

Dr. Bunte then proceeds to investigate the methods by which the efficiency could be increased.

Theoretically, the amount of air necessary for complete combustion of one cu.m. of generator gas is 0.454 cu.m., while 0.904 cu.m. of air is required in generating it in the first place ; the resultant 1.359 cu.m. of products of combustion have a net thermal value of 1049 units, and since their specific heat is 0.448, their initial temperature is $1049 \div 0.448 = 2341°C.$ If the final temperature of the waste gases were the same as before, 1129°C., they would carry off 506 units, or 45.8 per cent. of the total heat, showing an efficiency of furnace of 49.1 per cent.; when, therefore, just the required amount of air is supplied, there is an increased efficiency of 9 per cent.

This would indicate the desirability of adjusting the air supply by means of careful management of the dampers ; in practice, however, it would be obviously impossible to attain this economy continuously, since but very slight variations in the supply so seriously affect, as has been shown, the efficiency of the bench.

If, however, we examine the temperature of the escaping waste gas which, being 1129°C., is excessively high, we have a much more promising field for improvement. The losses from this source might be reduced in two ways :

First. By working the entire furnace at a lower temperature, in which case the capacity would, of course, be diminished. If the waste gases had a temperature of, say, 1000°C., instead of 1129°C., as before, the bench would have received the following increments of heat :

a. For excess of air.... $129 \times 1.617 \times 0.326 = 68$ units, or 6.2 per cent of 1105
b. For deficiency of air $129 \times 1.276 \times 0.326 = 54$ units, or 4.9 per cent.

This increase in efficiency, however, being secured at the expense of the carbonizing capacity of the bench, it will become a question of actual practice whether this really affords true economy or not.

Second. The second way of securing greater efficiency would be to utilize the heat of the waste gases by a system of *regeneration*, by means of which it would be returned to the furnace in the air that is required for combustion. It is true that in the Liegel generator furnace the air supply is heated ; this, however, is not done by regeneration in the real sense of the word, but rather at the expense of the heat developed in the generator, and before it has begun to be of direct service. It is immaterial by what means the heat thus developed reaches the bench proper, and, in this case, we have simply made the air the vehicle for this transfer of heat, and the efficiency of the furnace is not increased. Not so, however, when the regeneration is accomplished at the expense of the heat contained in the waste gases, and every such increment of heat directly adds to the efficiency.

The gain thus obtained depends upon two elements—the amount of air per kg. of carbon which is thus regenerated, and the temperature to which it is heated. Hence it will be seen at once that a greater relative economy can be expected from the effect of regeneration in the first of the two cases that we have assumed, viz.—when the air supply is in excess of what is theoretically required. If the temperature of the air after regeneration be assumed at 515°C., that of the air in the air flues of the present furnace, we have an additional amount of available heat of 114 units, making the total net thermal value of the products of combustion, $454 + 114 = 568$ units, and giving an efficiency of 51.4 per cent. as against 41.1 per cent. without regeneration. Then, again, it is more than probable that in heating the air to 515° the limit is far from being reached, and it would seem possible, by properly arranging the plant, to raise the temperature of the air supply to 1000°C., which would give an efficiency of 59 per cent.

In a general way, then, it will be seen that this increased efficiency due to regeneration becomes the more noticeable the greater the proportion of the total air supply which enters at the bench and the smaller the amount of air which enters at the generator slit. This consideration becomes one of especial importance when comparing the working of the ordinary Liegel furnace with that of a furnace in which a supply of steam enters the slit simultaneously with the air. The formation of carbonic oxide here takes place in an atmosphere largely composed of superheated steam, thus requiring a smaller supply of air at this point ; the total actual air supply, of course, remains the same in all cases, but in this instance the remaining air enters at the bench, that is, after regeneration. In the "dry" furnace, if

it may so be termed, the ratio of the air entering at the bench to that entering at the slit is as two to one, the latter portion being practically cold air; in the "wet" furnace, on the other hand, this proportion would be somewhat decreased owing to the diminished influx of air at the slit and the increased amount of hot air at the bench.

The absence of such provision for regeneration of the heat by the air supply is termed by Dr. Bunte the only feature of the Liegel furnace which merits adverse criticism.

[A Graduating Thesis Read before the Stevens Institute of Technology.]

Gas Engines.

By Albert Spies, M.E.

Centuries ago, when science and art were at a comparatively low state of cultivation, a general want was felt for some sort of motive power, and, consequently many attempts were made and devices resorted to in order to obtain the results aimed at. Among the first results of these attempts we may place the invention of Hero, of Alexandria, the reaction machine, in which the steam from a small boiler acted by a reactive force, like water in a hydraulic torniquet; then, again, reactive force was made use of by allowing steam jets to impinge on float-boards of paddle-wheels, and in the propulsion of small boats the steam jets were allowed to strike the surface of the water directly, thus causing motion.

These few instances, however, are merely mentioned as examples of the numberless devices which were thought of, and which were all equally valueless as efficient motors, a reliable source of power not having been obtained until human skill and ingenuity produced the steam engine. A short time after the introduction of the latter, new efforts were made to supply its place by more simple and less dangerous motors, and these efforts resulted in the production of the gas and hot air engines. The first gas engine made its appearance about 1791, and it was the invention of a man named John Barber, who, in the description of the engine, called it a "patent for using inflammable air to produce motion." Coal, oil, wood, or any combustible was placed in a retort and heated, the resulting smoke and vapor being collected and cooled in a reservoir. From this reservoir the gases were conveyed to a compressor by means of a pump, the compressor supplying an exploder. Common air was then injected in proper proportion, and the explosion was effected by means of a small flame.

Somewhat later, in 1794, Thomas Mead obtained a patent for an apparatus by means of which air, gas, or any elastic fluid coming in contact with some ignited combustible, became decomposed and, by expanding, acted on the piston of the engine. In his engine a vacuum was obtained under the piston, and the pressure of the atmosphere effected the return-stroke of the piston. This, as will be seen later, was, in a measure, the principle of the Otto and Langen engine. About the same time that Mead obtained a patent a new engine was introduced by Robert Street, from which engine the inventor proposed to obtain motion in the following way. A few drops of spirits of turpentine, poured on the heated bottom of the cylinder, would speedily be converted into vapor; air being then sucked into the cylinder would form an explosive mixture with the vapor and, upon ignition, the expansion would force the piston of the engine forward.

Automatically governed engines were introduced quite some time later—Lenoir's and Lemuel Wright's (1833) being among the first engines which were provided with governors to regulate the gas supply to the cylinders. Between 1833 and 1858 many patents were granted to inventors of gas engines, but few of these machines came into use. In the year 1859 M. Lenoir brought before the public his engine, which, as before stated, was provided with a governor, and the explosive charges of gas and air were fired by an electric spark, as we shall see in a later description. The invention of this engine was due, in all probability, to the following circumstances. It is known that an electric spark when passing through a mixture of air and hydrogen will cause the combustion of the latter, which, uniting with the oxygen of the air, forms water. This combustion necessarily causes an increase of temperature; and, if the sides of the vessel are movable, there will be an expansion and consequent increase of volume; if, however, the sides are not movable there will naturally be an increase of pressure. This is precisely what happens when coal gas is ignited.

These, then, were undoubtedly the facts which suggested to Mr. Lenoir his valuable invention, which was soon followed by Pierre Hugon's engine. The latter differed materially from the former in the manner of ignition of the explosive charges, which, in the Hugon engine, were exploded by a small gas jet introduced into the working cylinder at the proper moment. A shower of cold water was also introduced into the cylinder together with the charge, and although this considerably diminished the power of the engine, it tended to preserve the piston packing for a greater length of time. Some years later Fred Gilles, of Cologne, received a patent for several improvements in gas motors—his improved engine agreeing well with the following description. The cylinder was rather long, open at one end, and provided with two pistons, one of which was a loose piston and the other one a working piston, in connection with the shaft. In order to understand the action of the engine let us assume the working piston to be at the extremity of its inward stroke; if, then, the fly-wheel is turned, the piston under consideration will be drawn to the other end of the cylinder, followed by the loose piston, until the latter is stopped by a cross-head on the rod attached to it. The working piston, by continuing its onward motion, causes the formation of a partial vacuum behind it—in the space between the loose and the working piston. Into this space the mixed charge of gas and air is admitted and there exploded. The force of the explosion pushes the working piston to the end of its stroke, while the loose piston is moved in the opposite direction. A vacuum is again formed, and the working piston, by the pressure of the external air, returns to the loose piston, which is held at the top of the cylinder (the latter being in a vertical position) by some suitable mechanism. At a certain fraction of the stroke, the loose piston is released from its hold, and, falling rapidly, expels the products of combustion; this cycle of operations is then repeated at every revolution of the engine. It was built by L. Simon & Son, of Nottingham, and resembled an engine which was patented by a certain Francis Wenham, in May, 1864, the actions being almost exactly as in the above-mentioned engine.

Some time after the introduction of the Otto & Langen engine, Messrs. Simon & Son were granted a patent for improvements introduced by them, the explosive mixture in their engine being compressed by a pump and stored in a reservoir, from which it was drawn and used in fixed quantities, suitable valves under the control of the mechanism of the engine governing the supply to the cylinder. The pump was alongside of the cylinder, and the bed-plate of the engine, being cast hollow, was used as a receptacle for the compressed mixture. Mr. Simon also received a patent for an engine with an inverted cylinder and pump, motion being transmitted to the shaft by a vibrating-beam and connecting-rod. Steam was introduced into the working cylinder, together with the charge of gas and air; the steam was expanded by the heated cylinder walls and the heat of the explosion adding, to the power of the engine economizing gas and acting as a piston lubricant. Economy of gas consumption was also attained by introducing the gas in a series of small charges, which were inflamed successively, thus ensuring a gradual expansion. Another striking feature of this engine was the small amount of cooling water necessary.

Messrs. S. Clayton & Co. patented an engine, in 1878, which resembled the Otto engine very much, with the difference that it had a separate pump under the cylinder, which took in a supply of gas and air forcing it into the cylinder. The engine was made either double or single acting, was provided with a governor for the regulation of the gas supply, and in place of a slide valve it had a valve of a conical construction, similar to an ordinary cock. As to the economy of the engine but little is known, no experiments having been made to ascertain its gas consumption.

In December, of 1875, Edwin Alexander invented a gas engine, the cylinder of which was very long in comparison to diameter, so as to accommodate the piston speed to the explosive force. The stroke was ten or more times the diameter of the cylinder, and in place of a slide valve the engine was provided with a piston valve which was operated by an eccentric connected with the shaft. The cylinder was vertical, and the general action of the engine was as follows:

To start the engine, the fly-wheel, which should be quite heavy, must be turned through a portion of a revolution, thereby advancing the piston and taking in a charge of air and gas. After traversing about one-third of the stroke, the gas supply is cut off by the raising of the piston-valve, and the charge is ignited. The force of the explosion drives the piston upward through the whole length of the stroke, and the return or down-stroke is accomplished by the momentum of the heavy fly-wheel, thus forcing the products of combustion out of the cylinder. No lubricant is needed for this engine, and cooling-water is likewise dispensed with; but it has one important drawback—large gas consumption, and this probably prevented its extended use.

Three years later Dugald Clark brought before the public a horizontal, single-acting engine, provided with an air-pump and quite a novel way of igniting the charge. The latter is admitted to the pump by a valve (by means of suction) and on the return stroke of the pump-piston the mixture of air and gas passes into an intermediate chamber or reservoir which constitutes the back end of both cylinders. A piece of platinum wire is at one end of the working cylinder, and this wire, when once heated, remains so, since at each explosion of the mixture it receives a new supply of heat. The cylinder has a water-jacket, to prevent overheating, and a governor acts on a regulator-valve controlling the gas supply. An engine introduced by Mr. Bischof deserves mention. It was his intention to solve the problem of furnishing a light motor for domestic use, and his efforts resulted in the production of this engine, which has the following advantages over other forms of gas motors:

In the first place, it dispenses entirely with cooling-water, overheating of

the cylinder being prevented by a large amount of radiating surface in the form of numerous ribs and flanges.

Second. The engine utilizes the whole force of the explosion, which is rendered available, by a long stroke.

Third. The engine possesses great stability without especially prepared foundations.

Fourth. The sudden shock peculiar to most forms of gas engines is avoided by cushioning the air on the down-stroke.

Another gas engine which, however, never came into use, was the Ravel motor, called by its inventor "moteur à centre de gravitè variable." The Brayton engine, which deserves mention foremost among the important inventions of the last few years, will be explained and described more at length further on.

Having then briefly mentioned the more prominent inventions in this field of engineering let us compare, to some extent, steam and gas engines. Notwithstanding the many defects of the steam engines, it still maintains a high position as a prime mover for medium and high powers. Its compactness, and the high pressures which can be developed by the evaporation of water, without excessively high temperatures, render it especially desirable where powers higher than two or three HP. are needed. When, however, only a small power is necessary, and particularly if the action of the engine is intermittent, the steam engine must sooner or later give way to more economical and cheaper motors, which are, in a measure, offered in the form of gas and hot air engines. Steam engines always require skillful attendance, and besides this, it is to be considered that the consumption of fuel by the boiler goes on even if the engine is not doing any work. The cost of the attendance, together with the cost of the wastefully burned coal, for small powers, then becomes a large proportion of the total running expenses. There is also generally some difficulty in finding a proper location for both engine and boiler, and the danger which always accompanies the presence of boilers, as well as the first cost of the engine and the expense of repairs, must naturally interfere with its universal use. As a "domestic motor" it is hardly advisable to use it, since to claim approval in that respect the motor should be perfectly safe, compact, inexpensive in first cost, cleanly and durable, and should require but little attendance. An engine complying with all these conditions has not yet been introduced; but hot air, electric, and especially, gas engines are fast working their way into public favor for such uses as those above mentioned. They can be started at a moment's notice, they need no skilled engineer or attendant and, finally, what is important in the way of expense, they consume fuel only while running. There is no boiler to explode, no dust, no ashes, and little, if any noise.

[To be continued.]

Coal and Petroleum in Venezuela.

The United States Consul at Maracaibo, Mr. E. H. Plumacher, furnishes the following concerning the coal and petroleum resources of Venezuela—

The asphalt mines and petroleum fountains are most abundant in that part of the country lying between the River Zulia and the River Catatumbo and the Cordilleras. The wonderful sand-bank is about seven kilometers from the confluence of the Rivers Tara and Sardinarte. It is ten meters high and thirty meters wide and thirty meters long. On its surface can be seen several round holes, out of which rises the petroleum and water with a noise like that made by steam vessels when blowing off steam, and above there ascends a column of vapor. There is a dense forest around this sand bank, and the place has been called "El Inferno." Dr. Edward McGregor visited the sand bank, and reported to the Government that he had ascertained by experiment that one of the fountains spurted petroleum and water at the rate of 240 gallons per hour. The river, up to the junction of the Tara and Sardinarte, is navigable during the entire year for flat-bottomed craft of forty or fifty tons.

Mr. Plumacher has been unable to discover that there are any deposits of asphalt or petroleum in the upper part of the Department of Colon, beyond the Zulia, but he has been told that the valleys of Cucuta and the territories of the State of Tachira abound in coal mines. There are coal mines near San Antonia, in a ravine called "La Carbonera," and these supply coal for the smiths' forges in that place. Coal and asphalt are also found in large quantities in the Department of Sucre. Mr. Plumacher has seen, while residing in the State of Zulia, but one true specimen of "lignite," which was given to him by a rich land-owner, who is a Spanish subject. In the section where it was found there are several fountains of a peculiar substance. It is a black liquid of little density, strongly impregnated with carbonic acid which it transmits to the water which invariably accompanies it. Deposits of this substance are found at the foot of the spurs of the Cordilleras, and are believed to indicate the presence of great deposits of anthracite.

There are many petroleum wells of inferior quality between Escuque and Bettijoque in the towns of Columbia. Laborers gather the petroleum in handkerchiefs. After these become saturated, the oil is pressed out by wringing. It is burned in the houses of the poor. The people thought, in 1824, that it was a substance unknown elsewhere, and they called it the "oil of Columbia." At that time they hoped to establish a valuable industry by working it, and they sent to England, France, and this country samples which attracted much attention. But in these days no method of refining the crude oil had been discovered, and therefore these efforts to introduce petroleum to the world soon failed.

The plain of Ceniza abounds in asphalt and petroleum. There is a large lake of these substances about 12 kilometers east of St. Timeteo, and from it some asphalt is taken to Maracaibo. Many deposits of asphalt are found between these plains and the river Mene. The largest is that of Cienega de Mene, which is shallow. At the bottom lies a compact bed of asphalt which is not used at present, except for painting the bottoms of vessels to keep off the barnacles. There are wells of petroleum in the State of Falcon.

Mr. Plumacher says that all the samples of coal submitted to him in Venezuela for examination, with the exception of the "lignite" before mentioned, were, in his opinion, asphalt in various degrees of condensation. The sample which came from Tule he ranks with the coals of the best quality. He believes that the innumerable fountains and deposits of petroleum, bitumen and asphalt that are apparent on the surface of the region around Lake Maracaibo are proof of the existence below of immense deposits of coal. These deposits have not been uncovered because the territory remains for the most part as wild as it was at the conquest.—*Sci. News.*

Pure and Impure Water.

If there is any one subject connected with the household which requires more attention than another, it is that of pure water for man and beast. Every medical man knows impure water is a fertile source of disease in human beings, and innumerable outbreaks of a typhoid nature have been distinctly traced to this cause. Many of the diseases in cattle have their origin from the impure water which they are compelled to drink. In many localities in this country a "mud hole" or "sink" filled with partly stagnant water is the only source of supply for farm animals during the long, hot summer, and it is no wonder that diseases of various kinds follow such treatment.

There does not exist two sets of sanitary principles, one affecting human beings and the other the beasts of the field. Impure water, imperfect ventilation, dirt and damp, exercise injurious influences on the health of our domestic animals just as these agents do in the case of human beings. Every practical man should there foreseek to remove these sources of evil as speedily as possible.

Machinery and tools for obtaining good pure water have, of late, been perfected and simplified, so that there is no reason why every man should not have an abundant supply, both for household and stock, no matter where he is. Thousands of large land owners would be justified in purchasing the necessary machinery and tools for prosecuting their own work in this direction; and people with small places in the country would find it to their interest were they to club together and purchase the necessary outfit for sinking wells convenient to house and field. In the cities there are men who sink these wells for a specified price per foot, where the geological peculiarities of the section are known.—*Sci. Press.*

The Pumping Machinery of the Paris Water Works.

A large pumping-station will shortly be erected at Ivry, in connection with the Paris water supply. The works will comprise two large rectangular buildings, situated contiguously to each other, the one to contain the machinery and the other intended for the boilers. There will be six pumping engines in the machine room, which will measure 183 ft. 8 in. long and 78 ft. 8 in. wide. The boiler room will be 167 ft. 3 in. long and 55 ft. 8 in. wide, and there will be 12 furnaces ranged in one line, of which 10 will belong to Farcot tubular boilers, and the others to Belleville generators. Behind the buildings two chimneys 114 ft. 9 in. high, will serve to carry off the smoke. The machinery and boiler houses will have different ground levels, and as the natural line is very low, there will be a quantity of made soil to bring up the level of the approaches, courtyards, etc., to the required height. Ample coal stores will have to be provided, to guard against the possibility of a temporary failure in the supply.

Three isolated pavilions will afford residences for the superintendent, chief engineer and station keeper; and a separate building will be provided for offices, storerooms and workshops. The estimated cost of the work will amount to about £55,000, and the structure and machinery of the establishment is expected to be very fine. There are no particulars as to the quantity of water that is to be lifted at the new pumping station, nor the height to which it is to be raised.—*Journal of Gas Lighting.*

THE AMERICAN GAS LIGHT JOURNAL

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LIGHT, HEAT, STEAM, WATER-SUPPLY, VENTILATION, SANITARY IMPROVEMENT, AND GENERAL SCIENCE.

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TUESDAY, AUGUST 2, 1881.

Official Report of Examinations of Gas for three Weeks ending July 23, 1881, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1881. July.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
5	Between 9.30 A.M. and 1 P. M.	29.70	20.52	28.10	24.03	19.39	29.28
6		28.28	20.26	27.42	24.28	19.25	29.26
7		27.51	19.65	27.78	23.79	19.36	28.99
8		26.80	18.87	27.58	23.83	19 38	27.90
9		25.21	19.61	27.43	24.08	19.11	30.57
	Average	27.50	19.98	27.66	24.00	19.30	29.20
11		27.60	18.58	29.00	25.36	18.46	29.70
12		27.25	19.30	27.29	23.34	18.96	29.68
13		27.03	18.79	28.20	23.65	18.62	29.26
14		26.64	18.25	28.05	24.30	18.95	29.04
15		25.11	18.93	27.76	23.69	19.19	29.49
16		27.25	20.07	26.45	23.87	18.91	30.61
	Average	26.81	18.98	27.79	23.98	18.85	29.63
18		25.35	19.67	27.11	23.20	17.99	28.16
19		24.32	19.16	27.59	23.66	19.57	29.21
20		27.77	19.51	28.20	23.08	18.10	29.76
21		27.55	19.87	28.79	23.18	18.84	29.39
22		28.58	19.39	27 87	23.31	19.15	29.18
23		23.49	19.53	27.52	23.53	19.40	29.85
	Average	26.17	19.52	27.84	23.32	18.84	29.26

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Electric Light in the House of Commons.

So little satisfaction was afforded by the electric light in the recent experiments in illuminating the House of Commons, that the first night after the conclusion of the experiment, when gas was turned on, the members broke into cheers.

We understand that the lamps used in the late experiments in the House of Commons are to be removed, in spite of the intimation of Mr. Shaw-Lefevre that further experiments were to be made during the recess. It would appear that the opinion of the honorable members of the House was not favorable enough toward the new light to encourage further experiments.—*Review of Gas and Water Engineering.*

The Equitable Gas Light Company of Baltimore.

It has been a matter of common rumor in some quarters that the Equitable Gas Light Company of Baltimore, Md., had under consideration a proposition which involved the purchase of the works used by the Peoples Company of that city previous to consolidation.

There is no foundation whatever for such an assertion, and at no time since the formation of the new company has such an idea been entertained by its promotors. The contracts for the construction of the works of the Equitable Company have been awarded, and building operations are being vigorously prosecuted.

Fired by Electricity.

An interesting illustration of the danger attending the manufacture of some kinds of rubber goods was shown in the origin of the recent fire which ocurred in the Ætna Rubber Mills, at Jamaica Plains. The cement which fastens the seams of rubber coats is largely made of naphtha. The mere act of lifting a piece of rubber cloth from a pile of half a dozen similar ones, cut for garments, developed so much electricity that a spark was observed to escape. It came in contact with the naphtha cement, or with gases arising from it, and instantly the whole room was in a blaze. Fortunately the fire was extinguished without destroying the mill, the loss being only about a thousand dollars.

It is not known that anything can be done to prevent the occurrence of another accident of precisely the same kind, whenever all the atmospheric conditions are favorable. One would suppose, however, that a certain degree of dampness would remove all danger from that source.—*Commercial Bulletin.*

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
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AUGUST 2, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.	*Capital.*	*Par.*	*Bid.*	*Asked*
Central	$466,000	50	60	65
Harlem	1,800,000	50	84	86
" Bonds	170,000			103
Manhattan	4,000,000	50	192	201
Metropolitan	2,500,000	100	145	150x
" Scrip	1,000,000	..	102	103
Mutual	5,000,000	100	70	72
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	175	180
" Bonds	750,000		106	110
New York	4,000,000	100	102	104
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	119	122
Citizens	1,200,000	20	52	54
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	65	70
Peoples	1,000,000	10	35	40
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	62	64
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	60	65
" Bonds		...	98	103
Kings Co	135,000	100	55	60
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt			58	60
Bonds			107	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	155.000	40	117½	
Jersey City	750,000	20	145	155
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	95	100
" " Bds.				
Pittsfield, Mass			120	130
Rochester, N. Y		50	70	80
" Citizens		100	30	35
Woonsocket, R. I	150,000	100	80	...
Wilmington, Del		50	174	...
Yonkers		50	30	32
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C	1,500,000	20	130	200
" Scrip	500,000	20	150	160

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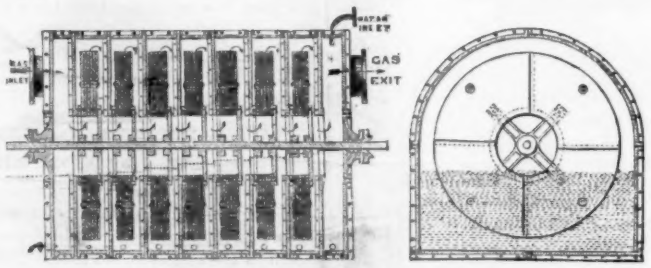

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And also President of the Yonkers Fuel Gas Co., and of the Westchester Gas Light Co.

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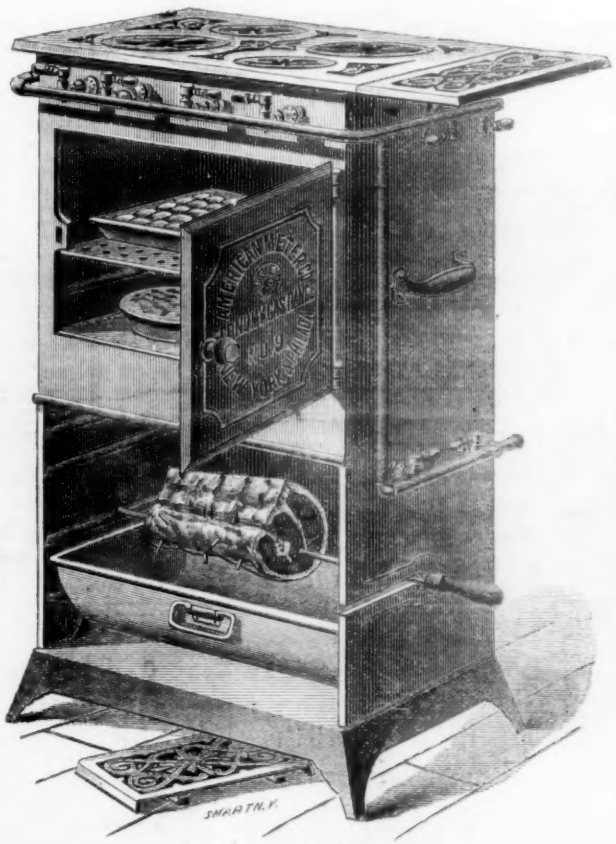

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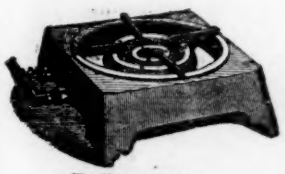
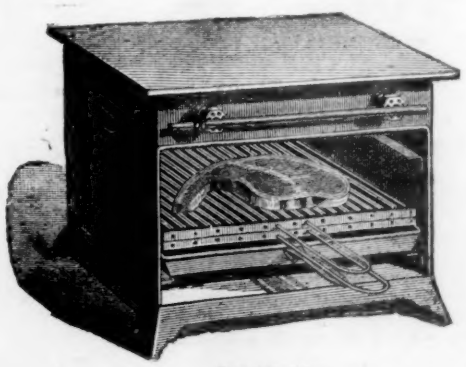


Boiling Stove.



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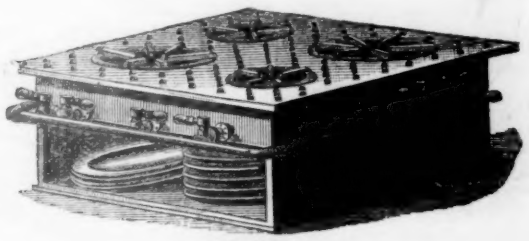

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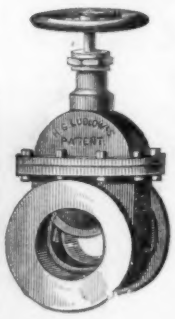

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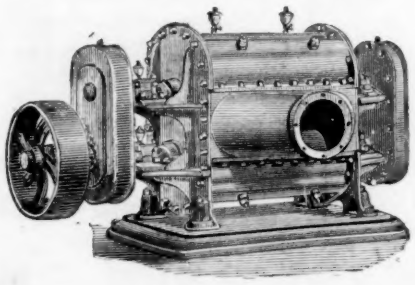

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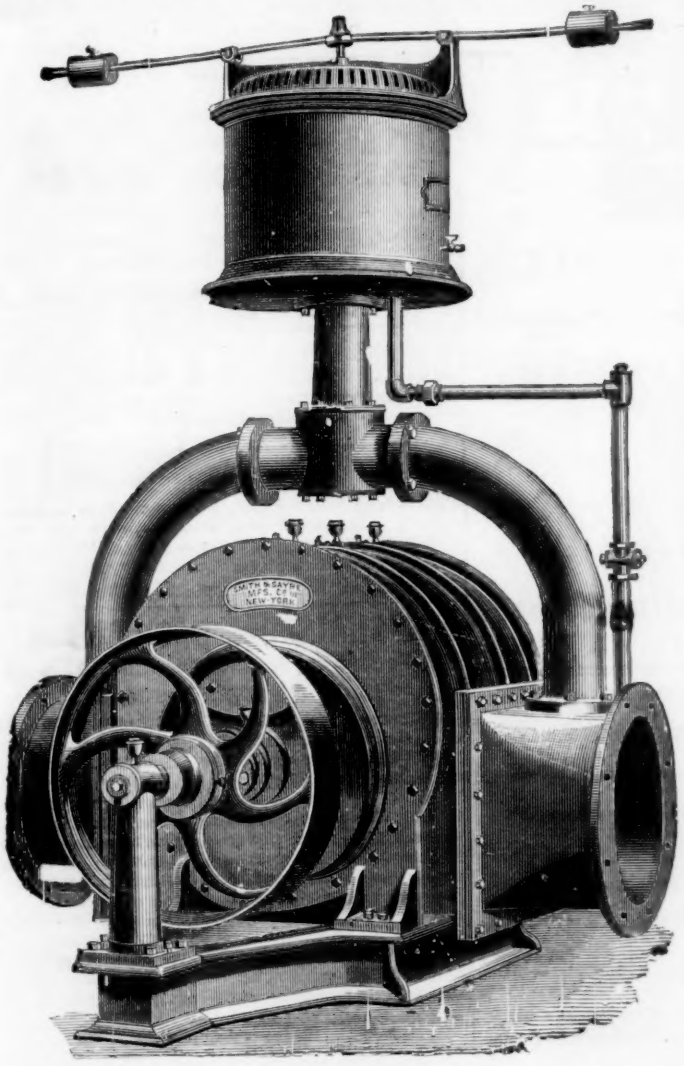

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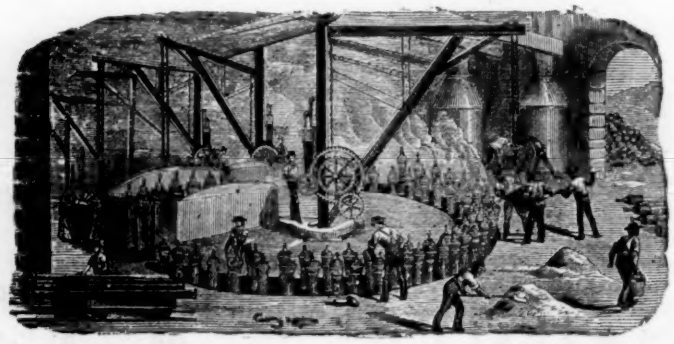

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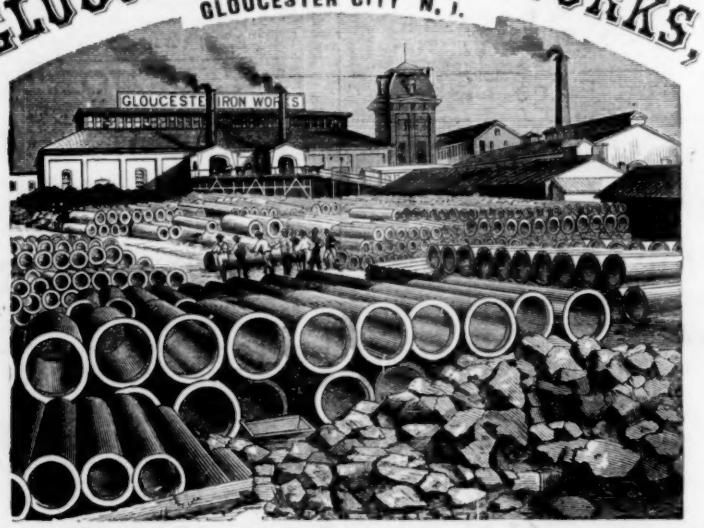

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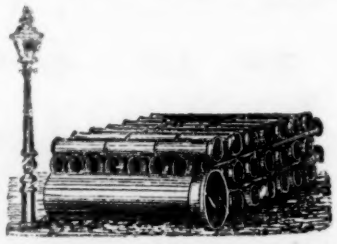

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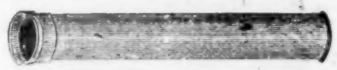

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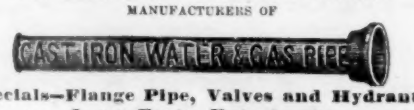

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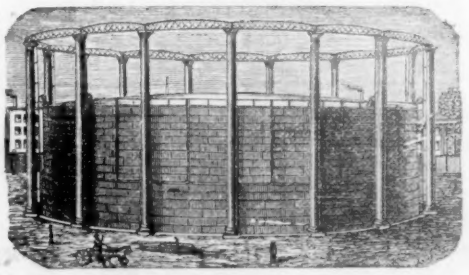

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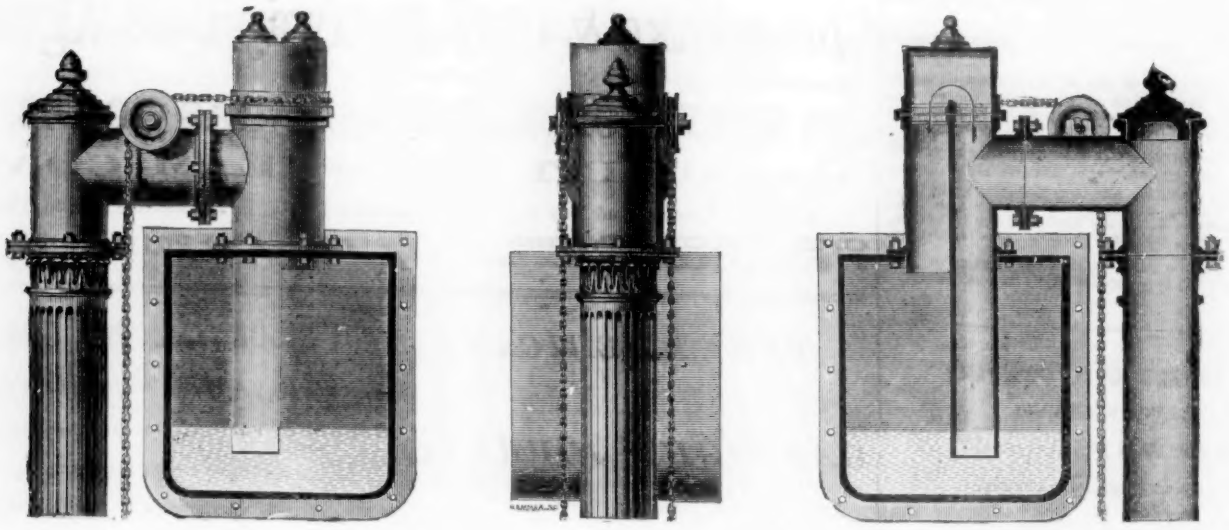

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